THE RELATIONSHIP BETWEEN THE WEIGHT OF EGGS AND THE WEIGHT OF CHICKS ACCORDING TO SEX [1]

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INTRODUCTION

In the domestic fowl the relationship between the weight of eggs and the weight of chicks according to sex at hatching time is an interesting problem, inasmuch as the mature male is normally heavier than the mature female. If the chicks of both sexes weigh practically the same at hatching time, then there remains an interesting study of different rates of growth of the sexes. On the other hand, if the weights of the sexes are significantly different at hatching time, it is of importance, then, to try to discover why the weights are different and whether the sexes of standard-bred chicks can be separated according to differences in weight.

This study was undertaken to determine, first, the relationship between the weights of chicks of the two sexes at hatching time; and, second, the relationship between the weights of the eggs and the weights of the chicks hatched from them.

PROCEDURE

The eggs used in this study were obtained from four different sources: 53 Rhode Island Red yearling hens, 30 Rhode Island Red pullets, 50 Barred Plymouth Rock yearling hens, and 113 Barred Plymouth Rock pullets. All the females were mated to Rhode Island Red cockerels. The eggs were saved from March 15 to March 23, when the incubators were set. Only a portion of the Rhode Island Red eggs laid during the period mentioned were used in this study. All the eggs laid by the Barred Plymouth Rocks were used. In this paper no account is taken of the infertile eggs, embryos which died during the period of incubation, and chicks which died in shell at hatching time. The eggs were weighed daily as laid, the weights being recorded to hundredths of a gram. The chicks were weighed at hatching time, the weights also being recorded to hundredths of a gram.

The sex of the chicks from the Barred Plymouth Rock females was recorded at hatching time, and that of the Rhode Island Red chicks when the chicks were 9 weeks old. Distinguishing the sex of chicks from the Barred Plymouth Rock females mated to Rhode Island Red males was an easy matter, since the sex-linked barring pattern of the barred females is transmitted to the sons only. The male chicks always have the white spot on the top of the head and yellow shanks, characteristic of purebred Barred Plymouth Rock male chicks, while the female chicks of this cross lack the white spot and have black or very dark shanks.

EXPERIMENTAL DATA

In Table I is shown, for each of the four groups of birds, the relationship between the weight of eggs from which males were hatched and the weight of the eggs from which females were hatched. In the case of the eggs from the Barred Plymouth Rock yearling hens, those giving rise to males have a slightly lower mean weight than the eggs giving rise to females, but in the other three cases the reverse is true. In no case, however, is the difference in weights significant, the differences with their probable errors being 0.34 ± 0.55, 0.60 ± 0.42, 0.44 ± 0.48, and 0.48 ± 0.34 gm.

This situation is in harmony with the results obtained by the senior writer [2] in the case of eggs from 30 Barred Plymouth Rock pullets mated to Brown Leghorn males, and by both authors [3] in the case of eggs from 153 Barred Plymouth Rock females mated to Rhode Island Red males. It seems, then, that selection of hatching eggs according to weight can not be expected to affect the sex ratio of chicks hatched therefrom.

TABLE I.—*Relationship between the mean weight of eggs producing males and the mean weight of eggs producing females in each of four groups; and the relationship of the mean weight of eggs producing males and females, respectively, between the yearling hen and pullet groups of each breed*

Group	Number	Mean weight of eggs from which males were hatched	Number	Mean weight of eggs from which females were hatched	Difference
		Gm.		*Gm.*	
Rhode Island Red yearlings	66	59.88±0.36	49	59.54±0.41	0.34±0.55
Rhode Island Red pullets	59	56.61±.30	54	56.01±.30	.60±.42
Difference		3.27±.47		3.53±.51	
Barred Plymouth Rock yearlings	63	59.91±.30	49	60.35±.37	.44±.48
Barred Plymouth Rock pullets	123	57.93±.24	106	57.45±.24	.48±.34
Difference		1.98±.38		2.90±.44	

Table I shows, for each of the two breeds, in the case of eggs giving rise to males and females, respectively, the difference in weights of eggs from yearling hens and from pullets. In both breeds the eggs from yearling hens were considerably heavier than the eggs from pullets. In the Rhode Island Reds, the difference in the weights of eggs giving rise to males is 3.27 ± 0.47 gm. in favor of the eggs from the yearling hens, and the difference in the weights of eggs giving rise to females is 3.53 ± 0.51 gm. in favor of the yearling hens. In the Barred Plymouth Rocks, the difference in the weights of eggs giving rise to males is 1.98 ± 0.38 gm. in favor of the yearling hens, and the difference in the weights of eggs giving rise to females is 2.90 ± 0.44 gm. In each case, the difference is considerably more than three times its probable error, and it is seen, then, that in both breeds the yearling hens laid significantly heavier eggs than the pullets.

The weights of the chicks of each sex from each of the four groups of birds are shown in Table II. In each of the four groups the mean weight of the females is lighter than that of the males, but in no

[2] JULL, M. A. THE RELATION OF ANTECEDENT EGG PRODUCTION TO THE SEX RATIO OF THE DOMESTIC FOWL. Jour. Agr. Research 28: 199–224. 1924.
[3] JULL, M. A., and QUINN, J. P. THE SHAPE AND WEIGHT OF EGGS IN RELATION TO THE SEX OF CHICKS IN THE DOMESTIC FOWL. Jour. Agr. Research 29: 195–202. 1924.

case is the difference significant, the differences with their probable errors being 0.63 ± 0.43, 0.81 ± 0.32, 0.11 ± 0.43, and 0.68 ± 0.25 gm. These results would indicate that chicks can not be assorted by sex at hatching time according to their weights.

TABLE II.—*Relationship between the mean weight of male chicks and the mean weight of female chicks, in each of four groups; and the relationship of the mean weight of male and female chicks, respectively, between the yearling hen and the pullet groups of each breed*

Group	Number	Mean weight of male chicks	Number	Mean weight of female chicks	Difference
		Gm.		*Gm.*	
Rhode Island Red yearlings_____	66	39.72±0.31	49	39.09±0.30	0.63±0.43
Rhode Island Red pullets_____	59	37.68± .23	54	36.87± .23	.81± .32
Difference_____	----------	2.04± .39	----------	2.22± .38	-----------
Barred Plymouth Rock yearlings_____	63	39.07± .28	49	38.96± .33	.11± .43
Barred Plymouth Rock pullets_____	123	37.99± .18	106	37.31± .18	.68± .25
Difference_____	----------	1.08± .33	----------	1.65± .38	-----------

Table II also shows the relationship between the weights of males and females, respectively, obtained from eggs laid by the yearling hens and from eggs laid by the pullets for each of the two breeds. In the case of the Rhode Island Reds, the difference in the mean weight of males from eggs laid by the yearling hens and from eggs laid by pullets is 2.04 ± 0.39 gm. in favor of the yearling hens, and the difference in the mean weight of females from eggs laid by yearling hens and from eggs laid by pullets is 2.22 ± 0.38 gm. in favor of the yearling hens. In the case of the Barred Plymouth Rocks, the difference in the mean weight of males from eggs laid by the yearling hens and from eggs laid by the pullets is 1.08 ± 0.33 gm., and the difference in the mean weight of females from eggs laid by yearling hens and from eggs laid by pullets is 1.65 ± 0.38 gm. The differences are significant in every case, and are what would naturally be expected in view of the significant differences in the mean weights of eggs laid by the yearling hens and by the pullets, as shown in Table I.

It might be possible, however, for chicks from eggs laid by pullets to be as heavy or even heavier than chicks from eggs laid by yearling hens, if the chicks from pullet eggs constitute a higher mean percentage of the mean egg weight than the chicks from yearling-hen eggs. Such a situation might be true whether the mean weight of the pullet eggs was as great or even less, as in the case of this study, than the mean weight of the yearling-hen eggs. In other words, do all chicks, whether they come from eggs laid by yearling hens or from eggs laid by pullets tend to constitute the same percentage of the weight of the eggs from which they were hatched?

The data in Table III show, for each of the four groups of birds and for the sexes, respectively, the chick weight times one hundred over the egg weight or the mean percentage chick weight of egg weight.

The female chicks constitute a lower mean percentage of the eggs from which they were hatched in all four cases. In no case, however, is the difference in mean percentage significant, the differences with their probable errors being: 0.68 ± 0.28, 0.73 ± 0.33, 0.60 ± 0.35, and 0.61 ± 0.30. It would seem, then, that in the case of neither

yearling hens nor pullets is there any significant difference in the mean percentage male and female chick weight of egg weight.

TABLE III.—*Relationship between the mean percentage chick weight of egg weight in eggs producing males and the mean percentage chick weight of egg weight in eggs producing females, in each of four groups; and the relationship between the mean percentage chick weight of egg weight in eggs producing males and females, respectively, in each breed*

Group	Number	Mean percentage chick weight of egg weight in eggs from which males were hatched	Number	Mean percentage chick weight of egg weight in eggs from which females were hatched	Difference
Rhode Island Red yearlings	66	66.33±0.19	49	65.65±0.21	0.68±0.28
Rhode Island Red pullets	59	66.56± .25	54	65.83± .22	.73± .33
Difference		.23± .31		.18± .30	
Barred Plymouth Rock yearlings	63	65.16± .23	49	64.56± .27	.60± .35
Barred Plymouth Rock pullets	123	65.60± .20	106	64.99± .23	.61± .30
Difference		.44± .30		.43± .35	

When the mean percentage chick weight of egg weight per sex between the yearling hens and pullets is considered, it is seen that in no case was there a significant difference. In every case, the mean percentage was greater in the case of the pullets than in the case of the yearlings. This is accounted for in the fact that the mean weight of the pullet eggs was somewhat lower than the mean weight of the yearling-hen eggs. The results in Table III tend to show that pullet eggs having the same weight as yearling-hen eggs tend to produce chicks having as great a mean weight as the chicks from eggs laid by yearling hens. In other words, the weight of the chick seems to be determined, more or less, by the weight of the egg from which it was hatched. The mean weight of the chicks hatched from small eggs, whether they be from yearlings or pullets, seems to be reduced according to the extent that the small eggs are used in incubation.

CONCLUSIONS

There is no significant difference between the weight of yearling-hen eggs from which males are hatched and the weight of yearling-hen eggs from which females are hatched.

There is no significant difference between the weight of pullet eggs from which males are hatched and the weight of pullet eggs from which females are hatched.

There is no significant difference in the weight of male chicks and the weight of female chicks from eggs laid by yearling hens.

There is no significant difference in the weight of male chicks and the weight of female chicks from eggs laid by pullets.

There is no significant difference in the percentage chick weight (in either sex) of egg weight in yearling hens as compared with pullets.

If pullet eggs have a significantly lower mean weight than yearling-hen eggs, the chicks hatched from pullet eggs will also tend to have a significantly lower mean weight than the chicks hatched from yearling-hen eggs.

The separation of the sexes of chicks at hatching time on the basis of weight is unreliable.